U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-269 234

Braunig Lake
Bexar County, Texas

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

Apr 77

PB 269 234

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY
WORKING PAPER SERIES

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON
and
ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

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TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.
3. RECIPIENT'S ACCESSION NO.	
4. TITLE AND SUBTITLE: Report on Braunig Lake, Bexar County, Texas	5. REPORT DATE: Prepared April 1977
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): Anonymous (National Eutrophication Survey Staff)	8. PERFORMING ORGANIZATION REPORT NO.: Working Paper # 634
9. PERFORMING ORGANIZATION NAME AND ADDRESS: National Eutrophication Survey U.S. Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97333	10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS: Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460	13. TYPE OF REPORT AND PERIOD COVERED: Final - 1974 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 06C

18. DISTRIBUTION STATEMENT: Release unlimited	19. SECURITY CLASS (This Report)	21. NO. OF PAGES: 34
	20. SECURITY CLASS (This page)	22. PRICE: PC A03 / MF A01

EPA Form 2220-1 (9-73)

REPORT

ON

BRAUNIG LAKE

BEXAR COUNTY

TEXAS

EPA REGION VI

WORKING PAPER NO. 634

WITH THE COOPERATION OF THE

TEXAS WATER QUALITY BOARD

AND THE

TEXAS NATIONAL GUARD

APRIL, 1977

1a

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Texas Water Quality Board for professional involvement, to the Texas National Guard for conducting the tributary sampling phase of the Survey, and to those Texas wastewater treatment plant operators who voluntarily provided effluent samples.

Hugh C. Yantis, Jr., Executive Director of the Texas Water Quality Board, and John B. Latchford, Jr., Director, and the staff of the Field Operations Division provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

Major General Thomas Bishop, the Adjutant General of Texas, and Project Officer Colonel William L. Seals, who directed the volunteer efforts of the Texas National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

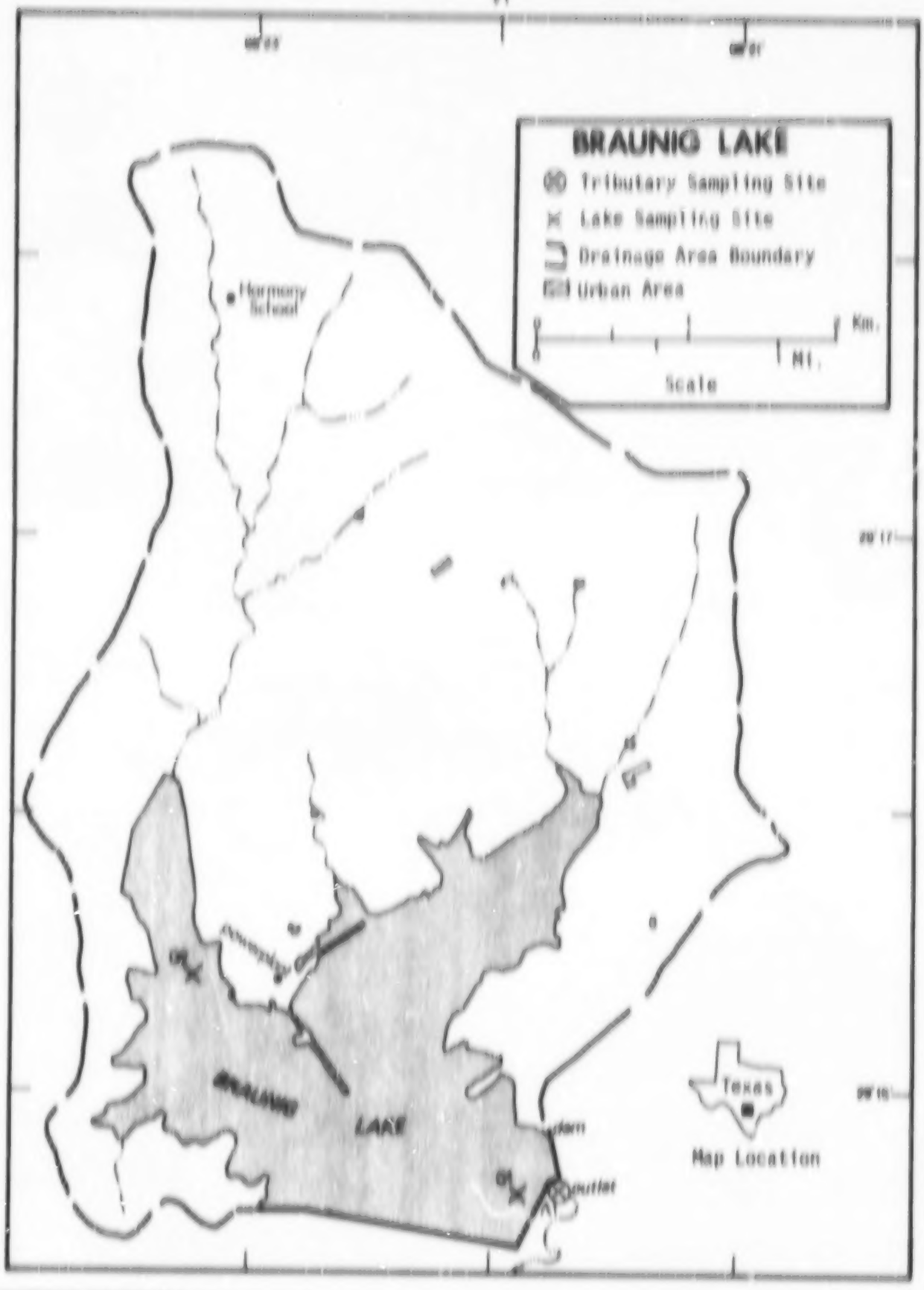
NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

State of Texas

NAME	COUNTY
Amistad	Val Verde
Bastrop	Bastrop
Belton	Bell, Coryell
Braunig	Bexar
Brownwood	Brown
Buchanan	Burnet, Llano
Caddo	Harrison, Marion, TX; Caddo Parish, LA
Calaveras	Bexar
Canyon	Comal
Colorado City	Mitchell
Corpus Christi	Jim Wells, Live Oak, San Patricio
Diversion	Archer, Baylor
Eagle Mountain	Tarrant, Wise
Fort Phantom Hill	Jones
Houston	Harris
Kemp	Baylor
Lake O'The Pines	Camp, Marion, Morris, Upshur
Lavon	Collin
Lewisville (Garza-Little Elm)	Denton
Livingston	Polk, San Jacinto, Trinity, Walker

Lyndon B. Johnson	Burnet, Llano
Medina	Bandera, Medina
Meredith	Hutchinson, Moore, Potter
O. C. Fisher (San Angelo)	Tom Green
Palestine	Anderson, Cherokee, Henderson, Smith
Possum Kingdom	Palo Pinto, Stephens, Young
Sam Rayburn	Angelina, Jasper Nacogdoches, Sabine, San Augustine
Somerville	Burleson, Lee, Washington
E. V. Spence	Coke
Stamford	Haskell
Stillhouse Hollow	Bell
Tawakoni	Hunt, Rains, Van Zandt
Texoma	Cooke, Grayson TX; Bryan, Johnston, Love, Marshall, OK
Travis	Burnet, Travis
Trinidad	Henderson
Twin Buttes	Tom Green
White River	Crosby
Whitney	Bosque, Hill
Wright Patman (Texarkana)	Bowie, Cass


BRAUNIG LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
Urban Area
Km.
Mi.
Scale
Harmony School
BRAUNIG
LAKE
Outlet
Texas
Map Location

BRAUNIG LAKE

STORET NO. 4804

I. INTRODUCTION

Braunig Lake was included in the National Eutrophication Survey as a water body of interest to the Texas Water Quality Board. Tributaries and nutrient sources were not sampled, and this report relates only to the lake sampling data.

II. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Braunig Lake is eutrophic; i.e., well supplied with nutrients and quite productive. Whether nutrient enrichment is beneficial or deleterious depends on the actual or potential effect on the uses of the lake. In this regard, the Texas Water Quality Board has indicated that there is little or no known impairment of the designated beneficial uses of this water body.

Braunig Lake ranked thirty-sixth when the 39 Texas reservoirs sampled in 1974 were compared using a combination of six parameters*. Thirty-six of the reservoirs had less median total and median dissolved phosphorus, 22 had less and one had the same median inorganic nitrogen, 35 had less mean chlorophyll a, and 19 had greater mean Secchi disc transparency. Near-depletion of dissolved oxygen with depth occurred at station 1 in May and August.

* See Appendix A.

B. Rate-Limiting Nutrient:

The algal assay results indicate primary productivity in Braunig Lake was limited by nitrogen. The lake data also indicate nitrogen limitation.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS[†]

A. Morphometry[††]:

1. Surface area: 5.46 kilometers^2.
2. Mean depth: 5 meters.
3. Maximum depth: =10.1 meters.
4. Volume: 32,760 x 10^6 m^3.
5. Mean hydraulic retention time: 3.7 years.

B. Outlet:
(See Appendix C for flow data)

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Unnamed Stream A-1	24.3**	0.28

C. Precipitation***:

1. Year of sampling: 94.0 centimeters.
2. Mean annual: 70.0 centimeters.

† Table of metric conversions--Appendix B.
†† Latchford, 1974.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976"; lake level maintained by a diversion from the San Antonio River.
** Includes area of lake.
*** See Working Paper No. 175.

IV. WATER QUALITY SUMMARY

Braunig Lake was sampled four times in 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at two stations on the lake (see map, page vi). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the March and November visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 10.1 meters at station 1 and 4.6 meters at station 2.

The sampling results are presented in full in Appendix D and are summarized in the following table (the August nutrient samples were not preserved properly and were not analyzed).

[illegible]

[illegible]	1ST SAMPLING : 3/12/76			2ND SAMPLING : 5/3/76			3RD SAMPLING : 8/13/76		
	2 SITES			2 SITES			2 SITES		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	24.3 - 25.4	25.4	25.4	24.1 - 31.1	28.6	28.6	27.1 - 35.1	31.4	24.1
[illegible]	5.4 - 8.2	5.8	5.3	4.8 - 5.8	4.4	4.5	5.2 - 6.2	5.3	5.8
[illegible]	105. - 125.	115.	115.	122. - 147.	135.	134.	135. - 150.	140.	135.
[illegible]	7.5 - 8.6	8.2	8.4	7.9 - 8.6	8.5	8.6	8.2 - 9.2	8.9	8.1
[illegible]	175. - 178.	177.	177.	164. - 175.	167.	168.	[illegible]	[illegible]	[illegible]
[illegible]	0.134 - 0.134	0.128	0.127	0.115 - 0.124	0.122	0.128	[illegible]	[illegible]	[illegible]
[illegible]	0.825 - 0.864	0.841	0.852	0.846 - 0.848	0.848	0.855	[illegible]	[illegible]	[illegible]
[illegible]	0.838 - 0.868	0.852	0.836	0.842 - 0.859	0.864	0.868	[illegible]	[illegible]	[illegible]
[illegible]	0.815 - 0.828	0.824	0.835	0.818 - 0.858	0.875	0.866	[illegible]	[illegible]	[illegible]
[illegible]	1.389 - 1.398	1.312	1.368	1.488 - 1.485	1.497	1.488	[illegible]	[illegible]	[illegible]
[illegible]	0.854 - 0.858	0.796	0.840	0.878 - 0.928	0.894	0.928	[illegible]	[illegible]	[illegible]
[illegible]	1.438 - 1.388	1.285	1.325	1.458 - 1.456	1.424	1.485	[illegible]	[illegible]	[illegible]
[illegible]	25.4 - 25.1	24.5	24.5	24.5 - 24.5	24.5	24.5	24.5 - 25.7	25.1	24.1
[illegible]	8.4 - 8.8	8.4	8.4	1.2 - 1.5	1.4	1.4	8.1 - 1.2	1.7	1.7

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/12/74	1. Centric diatoms	7,060
	2. Nitzschia sp.	5,750
	3. Merismopedia sp.	2,673
	4. Dactylococcopsis sp.	2,193
	5. Tetraedron sp.	1,980
	Other genera	1,851
	Total	21,523
06/21/74	1. Nitzschia sp.	654
	2. Chlorophytan coccoid cells	551
	3. Tetraedron sp.	482
	4. Mesostigma sp.	413
	5. Oscillatoria sp.	275
	Other genera	1,342
	Total	3,717
08/14/74	1. Centric diatoms	3,480
	2. Scenedesmus sp.	1,723
	3. Chlorococcalean coccoid cells	1,505
	4. Merismopedia sp.	627
	5. Oscillatoria sp.	564
	Other genera	2,980
	Total	10,879
11/05/74	1. Oscillatoria sp.	4,143
	2. Dactylococcopsis sp.	909
	3. Scenedesmus sp.	775
	4. Chlorophytan coccoid cells	642
	5. Lyngbya sp.	661
	Other genera	2,353
	Total	9,383

F. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
03/12/74	1	25.1
	2	23.9
05/21/74	1	14.8
	2	14.5
08/14/74	1	24.5
	2	33.7
11/05/74	1	25.9
	2	20.0

G. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. March sample -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.055	0.152	4.3
0.050 P	0.105	0.152	6.2
0.050 P + 1.0 N	0.105	1.152	19.6
1.0 N	0.055	1.152	14.4

b. November sample -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.117	0.195	2.6
0.050 P	0.167	0.195	2.6
0.050 P + 1.0 N	0.167	1.195	33.2
1.0 N	0.117	1.195	33.1

F. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Braunig Lake was high at the times the samples were collected. In both assays, there was an insignificant change in yield with the addition of orthophosphorus but a large increase in yield when only nitrogen was added. This indicates Braunig Lake was limited by nitrogen when sampled.

The lake data also indicate nitrogen limitation; i.e., inorganic nitrogen to orthophosphorus ratios were 5 to 1 or less at all stations in March, May, and November.

V. NUTRIENT LOADINGS

Insufficient flows in the tributaries during the sampling year prevented sampling. Therefore, estimates of nutrient loadings are not available.

VI. LITERATURE REVIEWED

Latchford, John B., Jr., 1974. Personal communication (morphometry). TX Water Qual. Bd., Austin.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

[illegible]

Rank	LAKE CODE	LAKE NAME	INDEX NO
1	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]

LAKES RANKED BY INDEX NOS.

NUM	LAKE CODE	LAKE NAME	INDEX NO
29	4421	LYNDON B JOHNSON LAKE	239
30	4424	TEXOMA LAKE	237
31	4425	SOMERVILLE LAKE	234
32	4426	SAN ANGELO RESERVOIR	230
33	4410	TEHUACANA LAKE	176
34	4415	BRAZOS LITTLE ELM RESERVO	173
35	4434	TRINIDAD	164
36	4404	BRAZOS LAKE	156
37	4411	CORPUS CHRISTI LAKE	155
38	4417	HOUSTON LAKE	139
39	4408	LEWISVILLE LAKE	91

LAKE DATA TO BE USED IN REVISIONS

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LAKE DATA TO BE USED IN [illegible]

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[illegible]	[illegible] LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] [illegible] RESERVOIR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] [illegible] RESERVOIR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] [illegible]

LAKE CODE	LAKE NAME	[illegible] TOTAL P	[illegible] [illegible] %	[illegible] [illegible] SEC	[illegible] [illegible]	[illegible] [illegible]	[illegible] [illegible]	[illegible]
[illegible]	[illegible] LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	LAKE [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] [illegible]

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	[illegible] TOTAL P	[illegible] [illegible]	[illegible] [illegible]	[illegible] CALCIUM	[illegible] [illegible]	[illegible] DISSOLVED [illegible]	[illegible] [illegible]
[illegible]	[illegible] LAKE	29 (23)	95 (23)	24 (4)	3 (1)	97 (25)	38 (10)	69
[illegible]	[illegible] LAKE	38 (7)	47 (17)	5 (2)	16 (7)	62 (31)	39 (14)	25
[illegible]	[illegible] [illegible] [illegible]	66 (33)	17 (14)	67 (32)	42 (35)	17 (6)	51 (14)	31
[illegible]	[illegible] LAKE	32 (12)	78 (28)	37 (14)	21 (8)	63 (24)	38 (10)	24
[illegible]	[illegible] LAKE	11 (4)	53 (19)	17 (5)	26 (9)	72 (27)	13 (5)	17
[illegible]	[illegible] LAKE	39 (14)	36 (13)	61 (23)	45 (17)	17 (8)	21 (7)	23
[illegible]	[illegible] LAKE	66 (33)	21 (7)	42 (25)	82 (31)	17 (8)	84 (31)	38
[illegible]	[illegible]	8 (3)	61 (22)	11 (4)	5 (2)	42 (25)	8 (3)	14
[illegible]	[illegible] [illegible] [illegible]	59 (22)	21 (7)	58 (22)	61 (23)	44 (17)	63 (23)	31
[illegible]	[illegible] [illegible] [illegible]	84 (32)	61 (22)	76 (29)	69 (34)	17 (9)	63 (23)	34
[illegible]	[illegible] LAKE	63 (24)	51 (19)	79 (30)	71 (27)	17 (8)	76 (28)	35

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107 x 10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

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APPENDIX D

PHYSICAL and CHEMICAL DATA

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[illegible]